

EPA-PNL-318

"Rebecca S Shaftel"  
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11/03/2011 08:38 PM

To "David Chambers"  
cc Phil North  
bcc  
Subject RE: Pebble Tailings Dam Volumes

Hi Dave,

Thank you for providing me with such a thorough answer. Phil or I will be in touch if we have questions.

Becky

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**From:** David Chambers [mailto:dchambers@csp2.org]  
**Sent:** Tuesday, November 01, 2011 10:11 AM  
**To:** Rebecca S Shaftel  
**Cc:** Phil North  
**Subject:** RE: Pebble Tailings Dam Volumes

Rebecca:

I don't place much confidence in the development schemes put forward in the Wardrop report, especially the 78-year case (it would probably be too expensive to mine ore that deep by the open pit method only), and even the 45-year case is weak because underground mining will surely have been initiated by then, and of course there is no plan for where the tailings for this case would go. I believe NDM/Wardrop only considered a tailings disposal scheme for the 25-year case because Site G is one of the few (and perhaps the only) locations in the Pebble area where the seepage from a tailings dam/impoundment might be controlled by bedrock.

We did a computer-generated estimate of area that would be required for tailings if the total mineral resource of 10.78 billion tons were to be developed. On one hand the total "mineral resource" is an optimistic estimate of the amount of ore (excluding waste rock) that would be mined, but this a number for which the company is held legally responsible, and it is also typical for a mine to increase its reserves after beginning operation, so for these reasons I can defend the use of this number. We did this estimate (see attached file "Mine Area Calculations – Sky Truth Sep10) before the Wardrop report was available. We used the 2006 information NDM/Knight

Piesold submitted to the Alaska Department of Natural Resources [Pebble Project Tailings Impoundment A (& G), Initial Application Report (Ref. No. VA101-176/16-13), Knight Piesold Ltd, September 5, 2006], which gave both volume and weight for the waste to be deposited in TSFs A & G.

The location of the tailings impoundments for the 10.78 buildout were taken from a study by Knight Piesold in 2006 that looked at a number of potential tailings impoundment locations (attached – summary only, the full report is not available).

The densities calculated from this report were 60.5 lbs/cu ft for TSF A and 68 lbs/cu ft for TSF G. Typical tailings density is typically between 85 and 120 lbs/cubic foot (Physical Aspects of Waste Storage From a Hypothetical Open Pit Porphyry Copper Operation, by Kenneth E. Porter and Donald I. Bleiwas, U.S. Geological Survey Open-File Report 03-143), but in the 2006 report NDM/Knight Piesold was assuming co-disposal of waste rock into the tailings impoundments, and although this waste rock was accounted for in Knight Piesold's volume calculations, it was not considered in the weight information, resulting in a lower average 'density'.

In the Wardrop report the waste rock will not go into TSF G, but will either be stored as waste rock piles near the pit, with the PAG waste being processed as low grade ore and the tailings backfilled into the pit (Wardrop 2011, Section 1.8.8 Waste Rock Management). This means the tailings density for TSF G in the Wardrop report should be in the conventional range of 85 – 120 lbs/cu ft.

I'd be happy to chat about this if you further questions.

Dave Chambers

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**From:** Rebecca S Shaftel [<mailto:rsshafte1@uaa.alaska.edu>]  
**Sent:** Thursday, October 20, 2011 5:04 PM  
**To:** [dchambers@csp2.org](mailto:dchambers@csp2.org)  
**Cc:** [North.Phil@epamail.epa.gov](mailto:North.Phil@epamail.epa.gov)  
**Subject:** Pebble Tailings Dam Volumes

Hi Dave,

I am working with Phil North on EPA's watershed assessment for Bristol Bay. We have been using GIS to estimate volumes for tailings ponds near the mine site that could hold the published tons of ore (pg. 280 in the 2/15/11 report by Ghaffari et al.). The volume calculations were based on hand digitized polygons and the ASTER DEM. We georeferenced the location for TSF G from Pebble's figures and also digitized three other possible tailings pond locations. In order to convert to tons, we used the value of 1.36 tons/m<sup>3</sup> based on a USGS publication (Porter and Bleiwas OFR 03-143).

Currently, we have estimated the total tons of ore held in TSF G at 1.5M ktons, which is much lower than Pebble's published 2.0M ktons. I originally contacted Marcus Geist at TNC to see if he had conducted a similar exercise and he suggested I contact you. Do you have any suggestions given our methodology? It would be especially helpful if you might direct us to a better estimate for the ore density from one of Pebble's published documents.

Thanks for your help. Please feel free to call me if you'd like to discuss over the phone.

Becky

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